Ant Colony Optimization algorithm mimics ants finding shortest path between their nests and food source using pheromones. Ant Colony Optimization (ACO) is population-based search technique for the solution of combinatorial optimization problems which is inspired by this behavior. An implementation of this algorithm is the travelling sales person problem. For example, consider an undirected weighed graph with 5 points representing towns, and the salesperson needs to minimize the distance travelled in visiting all towns.

To set up an ACO, we need: *Problem Representation* that allows the solution to be built up incrementally, *Desirability Heuristic n* to help in building up the solution, *Constraints* that permit only feasible/valid solution to be constructed, *Pheromone Update Rule* incorporating quality of the solution, *Probability Rule* that is a function of desirability and pheromone strength. For small number of nodes ACO is efficient, but for large number of nodes solving ACO’s may be computationally difficult.

Other applications of this algorithm include: bus routes, garbage collection, delivery routes, feeding of lacquering machines, protein folding, personnel placement in airline companies, vehicle routine, graph coloring, and composition of products. Finding the shortest path between two nodes is a broad implementation of the algorithm.

An implementation of ACO towards multimedia databases is clustering images that are of the same thing, a combination of low level visual features in clustering; each group of images may correlate with respect the different set of important features and each group may contain some irrelevant features. ACO is implemented for optimizing feature weights of each cluster of images. ACO is also used to summarize videos, or series of images. The ability of ants to build live structures with their bodies in order to discover, in a distributed and unsupervised way, a tree-structured organization and summarization of the video data.

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<https://www.slideshare.net/MeenakshiDevi/ant-colony-optimization-11696728>

<https://www.powershow.com/view1/639dc-ZDc1Z/Clustering_of_Visual_Data_using_Ant-inspired_Methods_powerpoint_ppt_presentation>

It is pretty wild that a basic biological creature is providing us with insights into complex systems/algorithms that run the universe. I enjoyed reading about this!